

CLAIMS: I claim:

1. A machine used for digital communications, comprising:
  - a. a first symbol constellation having at least two symbols, said two symbols having differing amplitudes and each having non-zero probability, and said first symbol constellation having a first second-order statistic and a second second-order statistic, where
    - i. said first second-order statistic is the expected value over all symbols in said first symbol constellation of each symbol multiplied by its complex conjugate and
    - ii. said second second-order statistic is the expected value over all symbols in said first symbol constellation of each symbol multiplied by itself
  - b. a second symbol constellation having a third second-order statistic and a fourth second-order statistic, where
    - i. said third second-order statistic is the expected value over all symbols in said second symbol constellation of each symbol multiplied by its complex conjugate and
    - ii. said fourth second-order statistic is the expected value over all symbols in said second symbol constellation of each symbol multiplied by itself and
    - iii. said fourth second-order statistic is not equal to said second second-order statistic
  - c. means for periodic selection of a symbol from said first symbol constellation
  - d. means for periodic selection of a symbol from said second symbol constellation.
2. The machine of claim 1 further including means for estimating parameters of a linear channel using said second second-order statistic of claim 1 and said fourth second-order statistic of claim 1.

3. The machine of claim 1 further including means for estimating parameters of a linear channel equalizer said second second-order statistic of claim 1 and said fourth second-order statistic of claim 1.
4. The machine of claim 1 further including means for estimating parameters of a nonlinear channel using said second second-order statistic of claim 1 and said fourth second-order statistic of claim 1.
5. The machine of claim 1 further including means for estimating parameters of a nonlinear channel equalizer using said second second-order statistic of claim 1 and said fourth second-order statistic of claim 1.
6. The machine of claim 1 wherein said first second-order statistic of claim 1 is equal to said third second-order statistic of claim 1, further including means for estimating parameters of a linear channel using said second second-order statistic of claim 1 and said fourth second-order statistic of claim 1.
7. The machine of claim 1 wherein said first second-order statistic of claim 1 is equal to said third second-order statistic of claim 1, further including means for estimating parameters of a linear channel equalizer using said second second-order statistic of claim 1 and said fourth second-order statistic of claim 1.
8. The machine of claim 1 wherein said first second-order statistic of claim 1 is equal to said third second-order statistic of claim 1, further including means for estimating parameters of a nonlinear channel using said second second-order statistic of claim 1 and said fourth second-order statistic of claim 1.
9. The machine of claim 1 wherein said first second-order statistic of claim 1 is equal to said third second-order statistic of claim 1, further including means

for estimating parameters of a nonlinear channel equalizer using said second second-order statistic of claim 1 and said fourth second-order statistic of claim 1.

- 10.** A method used for digital communications, comprising:
- a. periodic selection of a symbol from a first symbol constellation having at least two symbols, said two symbols having differing amplitudes and each having non-zero probability, and said first symbol constellation having a first second-order statistic and a second second-order statistic, where
    - i. said first second-order statistic is the expected value over all symbols in said first symbol constellation of each symbol multiplied by its complex conjugate and
    - ii. said second second-order statistic is the expected value over all symbols in said first symbol constellation of each symbol multiplied by itself
  - b. periodic selection of a symbol from a second symbol constellation having a third second-order statistic and a fourth second-order statistic, where
    - i. said third second-order statistic is the expected value over all symbols in said second symbol constellation of each symbol multiplied by its complex conjugate and
    - ii. said fourth second-order statistic is the expected value over all symbols in said second symbol constellation of each symbol multiplied by itself and
    - iii. said fourth second-order statistic is not equal to said second second-order statistic.
- 11.** The method of claim 10 further including estimation of parameters of a linear channel using said second second-order statistic of claim 10 and said fourth second-order statistic of claim 10.

12. The method of claim **10** further including estimation of parameters of a linear channel equalizer using said second second-order statistic of claim **10** and said fourth second-order statistic of claim **10**.
13. The method of claim **10** further including estimation of parameters of a nonlinear channel using said second second-order statistic of claim **10** and said fourth second-order statistic of claim **10**.
14. The method of claim **10** further including estimation of parameters of a nonlinear channel equalizer using said second second-order statistic of claim **10** and said fourth second-order statistic of claim **10**.
15. The method of claim **10** wherein said first second-order statistic of claim **10** is equal to said third second-order statistic of claim **10**, further including estimation of parameters of a linear channel using said second second-order statistic of claim **10** and said fourth second-order statistic of claim **10**.
16. The method of claim **10** wherein said first second-order statistic of claim **10** is equal to said third second-order statistic of claim **10**, further including estimation of parameters of a linear channel equalizer using said second second-order statistic of claim **10** and said fourth second-order statistic of claim **10**.
17. The method of claim **10** wherein said first second-order statistic of claim **10** is equal to said third second-order statistic of claim **10**, further including estimation of parameters of a nonlinear channel using said second second-order statistic of claim **10** and said fourth second-order statistic of claim **10**.
18. The method of claim **10** wherein said first second-order statistic of claim **10** is equal to said third second-order statistic of claim **10**, further including estimation of parameters of a nonlinear channel equalizer using said second

second-order statistic of claim **10** and said fourth second-order statistic of claim **10**.